THE NATIONAL INSTITUTE OF ENGINEERING
MYSORE – 8

(Autonomous Institution under VTU)

Bachelor of Engineering

Scheme & Detailed Syllabus of

V Semester

B.E (Computer Science and Engineering)

Department of Computer Science and Engineering

SCHEME OF TEACHING AND EXAMINATION
V SEMESTER

Sl.No.	Subject Code	Subject	Category	L	T	P	Cr.
1	CS5C01	Microprocessor and Interfacing	Core	3	2	0	4
2	CS5C02	Operating Systems	Core	3	2	0	4
3	CS5C03	Database Management Systems	Core	3	0	0	3
4	CS5C04	System Software	Core	3	2	0	4
5	CS5C05	Engineering Management	Core	3	0	0	3
6	CS5MXX	MOOC Elective	MOOC Electives	3	0	0	3
7	CS5L01	Microprocessor and Interfacing Laboratory	Lab	0	0	3	1.5
8	CS5L02	Database Laboratory	Lab	0	0	3	1.5
9	MA5CL1	Applied Mathematics-II (only for lateral entry students)	Core	3	0	0	3
	Total Credits						**24/27**
	Total Contact Hrs						**30**

MOOC ELECTIVES (3 Credits)

Sl.No.	Subject Code	Subject	L:T:P
1	CS5M03	Introduction to Internet of Things	3:0:0
2	CS5M04	Social Networks	3:0:0
3	CS5M05	Introduction to Machine Learning	3:0:0
3	CS5M06	Software Testing	3:0:0
4	CS5M07	Developing soft Skills & Personality	3:0:0
5	CS5M08	Innovation by Design	3:0:0
6	CS5M09	Data Science and Engineering	3:0:0
7	CS5MXX	Parameterized Algorithms	3:0:0
8	CS5MXX	Computer Vision	3:0:0
9	CS5MXX	Natural Language Processing	3:0:0

V SEMESTER

MICROPROCESSOR AND INTERFACING (3:2:0)

Sub code	**: CS5C01**	**CIE**	**: 50 %**
Hrs / week	**: 05**	**SEE**	**: 50 %**
SEE Hrs	**: 3 Hrs**	**Max. Marks**	**: 100**

Prerequisite: Logic Design

Course Outcome:

On successful completion of the course the students will be able to

1. Describe 8086 Architecture and its addressing modes.
2. Illustrate the use of data transfer instructions.
3. Illustrate Arithmetic, Logical, Shift and Control Instructions.
4. Describe the Hardware configurations of 8086 processor.
5. Discuss Pentium processor and ARM microcontroller Architecture.

MODULE 1:

The Microprocessor and its Architecture: Internal Microprocessor Architecture, Real Mode Memory Addressing. Addressing modes: Data Addressing Modes

***SLE**: Program Memory Addressing Modes.* **7 Hours**

MODULE 2:

Assembler Language programming – I:

Data Movement Instructions: MOV, PUSH/POP, Load-Effective Address, String Data Transfers, Miscellaneous Data Transfer Instructions.

***SLE**: Assembler Details.* **8 Hours**

MODULE 3:

Assembler Language programming – II:

Arithmetic and Logic Instructions: Addition, Subtraction and Comparison, Multiplication and Division. Basic Logic Instructions, Shift and Rotate

Program Control Instructions: The Jump Group, Procedures.

***SLE:** String Comparisons* **8 Hours**

MODULE 4:

Interrupts: Introduction to Interrupts, System Bus Structure: Minimum mode 8086 pin configurations, 8255 Interfacing: mode 0, Interfacing example LED, Stepper motor, Display, keypad,

SLE: *Maximum mode* **8 Hours**

MODULE 5:

Introduction to Pentium Microprocessor, Special Pentium Registers, , New Pentium instructions

ARM-32 bit Microcontroller: Architecture of ARM Cortex M3, General Purpose Registers, Special Registers, exceptions, interrupts. Assembly basics

SLE: Various Units in the architecture **8 Hours**

TEXT BOOK

1. The Intel Microprocessors, Barry.B.Brey, PHI Publication, 8th edition, 2009.
2. The Definitive Guide to the ARM Cortex-M3, Joseph Yiu, 2nd Edition, Newnes, (Elsevier), 2010

REFERENCE BOOKS

1. Microprocessor and Interfacing, Douglas V.Hall, TMH, 2nd edition 2006
2. Microprocessor Systems: The 8086/8088 Family, Glenn A.Gibson, Prentice-Hall of India, 2nd Edition, 1986.
3. The Intel Microprocessor Family: Hardware and Software Principles and Applications, James L. Antonakos, Thomson, 2007

OPERATING SYSTEMS (3:2:0)

Sub code	**: CS5C02**	**CIE**	**: 50 %**
Hrs / week	**: 05**	**SEE**	**: 50 %**
SEE Hrs	**: 3 Hrs**	**Max. Marks**	**: 100**

Course Outcomes:

On successful completion of the course the students will be able to

1. Understand the process management policies and process scheduling
2. Illustrate the concepts of synchronization.
3. Understand various strategies of Memory Management especially Paging and Segmentation.
4. Apply various Page Replacement Techniques and identify the design issues in paging.
5. Illustrate the various mechanisms to handle deadlock.

MODULE 1:

Introduction: what is an operating system? The Operating system as an extended machine, The Operating system as a resource manager.

Processes: The process model, Process creation, Process termination, Process hierarchies, Process states.

Threads: The Thread model, Thread usage, implementing threads in user space, implementing threads in the kernel, Hybrid implementations, Scheduler activations.

Scheduling: Introduction to scheduling, Scheduling in batch Systems,

SLE: *Scheduling in interactive systems.* **7 Hours**

MODULE 2:

Interprocess communication: Race conditions, Critical regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors.

Classical IPC problems: The dining philosophers' problem, The Readers and Writers problem.

SLE: *Message Passing, Barriers* **8 Hours**

MODULE 3:

Memory Management: Background; Swapping; Contiguous Memory Allocation; Paging; Structure of the page Table; Segmentation.

Virtual Memory: Background; Demand Paging; Copy-on-Write; Allocation of frames.

SLE: *Thrashing* **9 Hours**

MODULE 4:

Page Replacement Algorithms: The optimal page replacement algorithm, The not recently used page replacement algorithm, The first-in first-out, The second chance page replacement algorithm, The clock page replacement algorithm, The least recently used.

Design issues for paging systems: Local versus Global allocation policies, Load control, Page size, Separate instruction and data spaces, Shared pages, Shared libraries.

SLE: *Mapped Files, Cleaning Policy, Virtual Memory Interface* **8 Hours**

MODULE 5:

Deadlocks: **Introduction to deadlocks**: Conditions for deadlock, Deadlock modeling.

Deadlock detection and recovery: Deadlock detection with one resource of each type, Deadlock detection with multiple resource of each type, Recovery from deadlock.

Deadlock avoidance: Resource trajectories, Safe and Unsafe States, The Banker's algorithm for a single resource, The banker's algorithm for multiple resources.

Deadlock prevention: Attacking the Mutual-Exclusion Condition, Attacking the Hold-and-Wait condition, Attacking the No-Preemption condition, Attacking the Circular Wait condition

SLE: *Two-Phase Locking, Starvation.* **7 Hours**

TEXT BOOKS:

1. **Modern Operating systems, 4th** Edition, Andrew S.Tanenbaum, Herbert Bos Pearson Education Limited ; Global Edition.

   (MODULE1, MODULE 2, MODULE 4, MODULE 5)

2. **Operating System Principles –** Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley-India, 7th edition, 2006.

   (MODULE 3)

REFERENCE BOOKS:

1. Operating Systems, William Stallings, PHI, Fourth Edition
2. Operating Systems, Milan Kovic, Tata McGraw Hill, 2001.
3. Operating System Design: v. 1: The Xinu Approach (Prentice-hall Software) Douglas Comer.
4. TUNIX Operating Systems: A Practical Approach, Robert Switzer, Prentice-Hall, 1993.

E-BOOKS:

1. Operating Systems Guide :by Tim Bower
2. Operating Systems Course Notes: by Dr. John T.Bell
3. Schaum's Outline of Operating Systems (Schaum's Outline Series) [Kindle Edition] by J. Archer Harris.

MOOCs:

1. http://www.nptel.ac.in/courses/106108101/

DATABASE MANAGEMENT SYSTEMS (3:0:0)

Sub code	**: CS5C03**	**CIE**	**: 50 %**
Hrs / week	**: 03**	**SEE**	**: 50 %**
SEE Hrs	**: 03 Hrs**	**Max. Marks**	**: 100**

Prerequisite: File Systems

Course Outcomes:

On successful completion of the course the students will be able to

1. Infer different database models and creation of MySQL database.
2. Design the database using Entity Relationship model and Normalization.
3. Apply SQL query to interact with the database and illustrate transaction concepts.
4. Create triggers, constraints and indexes in MySQL.
5. Demonstrate the use of views and database recovery techniques.

MODULE 1:

Introduction: Advantages of using a DBMS approaches, Definition of schema, data model and instances, Three-schema architecture and data independence, Different Database Models, Interfacing with a Database, The Mechanics.

An Example Database: The Everest Books Database

Relational Databases (with a MySQL Flavor): MySQL Database System, Database Organization, Creating and using the Database.

SLE: *Disk versus Main-Memory, Steps in Designing a Database.* **8 Hours**

MODULE 2:

Manipulating the Database: Example Tables, Relational Algebra.

Database Design 1: *The Entity-Relationship Model*- Entity, Entity Sets, Attributes, Relationships, Constraints on Relationship types, Weak entity type, Notations for ER Diagrams,

Database Design 2: Definition of Functional Dependencies, Normal Forms Based on Primary Keys - 1NF, 2NF, 3NF, BCNF

SLE: *Modeling The Everest Books' Database, Ad Hoc Database Design* **8 Hours**

MODULE 3:

SQL: Basics, Data Definition Language, Data Manipulation Language, Stored Routines, Formatting and SQL.

Transactions: Informally Speaking, Transactions in SQL, Transaction Semantics, Serializability, Locks, SQL Isolation Levels, Transactions in MySQL

SLE: *Orders, Invoices & Reports* **8 Hours**

MODULE 4:

Constraints: Constraints in SQL, Constraint Check Time.

Triggers: Triggers in SQL.

Indexes: How does an Index Work?, Types of Indexes, Different Types of Indexes, Hash Indexes, Indexes in MySQL,

SLE: *Some Thoughts on Indexing* **8 Hours**

MODULE 5:

Views: Two Implementations of Views, Views in MySQL, Examples.

Logs and Recovery: Failure Types, Logs, Log Details, Some Log Characteristics, Database Recovery, MySQL.

SLE: *Database Recovery Example* **7 Hours**

TEXT BOOKS:

1. The Database Book: Principles and Practice using MySQL, NarainGehani, Universities Press(India) Private Limited 2008.
2. Fundamentals of Database Systems, Elmasri and Navathe, Addison-Wesley, 7th Edition, 2016.

REFERENCE BOOKS:

1. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill, 3rd Edition, 2003.
2. Silberschatz, Korth and Sudharshan: Database System Concepts, 6th Edition, McGrawHill, 2010.

SYSTEM SOFTWARE (3:2:0)

Sub Code : CS5C04	**CIE : 50%**
Hrs/week : 05	**SEE : 50%**
SEE Hrs : 03	**Max. Marks : 100**

Prerequisite: Computer Organization

Course Outcome:

On successful completion of the course the students will be able to

1. Describe different features of SIC and SIC/XE machine architecture.
2. Analyze the basic concepts of an assembler characteristics and functions.
3. Discuss the machine independent assembler features.
4. Describe the design and implementation of Loaders and Linkers.
5. Implement scanner and parser using LEX and YACC.

MODULE 1:

Introduction: System software and machine architecture.

Machine Architecture: The Simplified Instructional Computer (SIC) – SIC Machine Architecture, SIC/XE Machine Architecture, SIC, SIC/XE Programming Examples.

SLE: *CISC machines, RISC machines, Comparison of CISC and RISC.* **8 Hours**

MODULE 2:

Assemblers – 1: Basic Assembler Function – A Simple SIC Assembler, Assembler Algorithm and Data Structures. Machine Dependent Assembler Features – Instruction Formats & Addressing Modes,

SLE*: Implementing Assembler Data structure like symbol table etc*. **8 Hours**

MODULE 3:

Assemblers – 2: Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking.

SLE: *Assembler Design Options – One-Pass Assembler, Multi-Pass Assembler.* **8 Hours**

MODULE 4:

Loaders and Linkers: Basic Loader Functions – Design of an Absolute Loader, A Simple Bootstrap Loader.

Machine - Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader.

SLE : *Loader Design Option-Linkage editors, Dynamic Linking.* **7 Hours**

MODULE 5:

Introduction to LEX and LEX structure: Lexical Analysis, Metacharacters in LEX, LEX predefined variables, functions and macros, LEX program execution.

Introduction to YACC and YACC structure: Syntax Analysis, A YACC Parser, Running LEX and YACC, Compiling and Running a Simple Parser.

SLE*: Implementing a simple SIC assembler* **8 Hours**

TEXT BOOKS:

1. **System Software,** Leland L Beck, 3rd Edition, Addison-Wesley Reprint 2013.
2. **Lex and Yacc** – John R Levine Mason and Doug Brown, O'Reilly, SPD, 1998.

REFERENCES:

1. **System Programming and Operating Systems,** D M Dhamdhere, TATA McGraw Hill, 2nd Edition, 2006.

ENGINEERING MANAGEMENT (3:0:0)

Sub Code	**: CS5C05**	**CIE**	**: 50 %**
Hrs / Week	**: 03**	**SEE**	**: 50 %**
SEE Hrs	**: 3 Hrs**	**Max. Marks**	**: 100**

***Course outcomes*:**

On successful completion of the course the students will be able to

1. Describe the characteristics and areas of management.
2. Explain the nature and purpose of planning and organizing.
3. Explain the importance of staffing directing and controlling, meaning and steps in controlling.
4. Interpret the qualities and characteristics of an entrepreneur.
5. Propose a project report on small-scale industry.

MODULE 1:

Management: Introduction: Meaning - nature and characteristics of Management, Scope, and functional areas of management - Management as a science, art or profession, Management & **Administration** - Roles of Management, Levels of Management.

SLE: *Development of Management Thought - early management approaches - Modern management approaches, case studies on administration and management.* **7 Hours**

MODULE 2:

Planning: Nature, importance, and purpose of planning process - Objectives - Types of plans (Meaning only) - Decision making - Importance of planning - steps in planning & planning premises - Hierarchy of plans. Organizing: Nature and purpose of organization - Principles of organization - Types of organization Departmentation - Committees – Centralization Vs Decentralization of authority and responsibility - Span of control MBO and MBE (Meaning only).

SLE: *Case studies on planning and organizing.* **8 Hours**

MODULE 3:

Staffing: Nature and importance of Staffing - Process of Selection & Recruitment Directing & **Controlling:** Meaning and nature of directing - Leadership styles, Motivation Theories, Communication- Meaning and importance Coordination, meaning and importance and Techniques of Co - ordination. Meaning and steps in controlling Essentials of a sound control system - Methods of establishing control.

SLE: *Cases studies on staffing, directing & controlling.* **8 Hours**

MODULE 4:

Entrepreneur: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneurs, Entrepreneur - an emerging Class. Concept of Entrepreneurship-Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

SLE: *Case studies on entrepreneurs and overcoming barriers.* **8 Hours**

MODULE 5:

Small Scale Industry: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start an SSI - Government policy towards SSI; Different Policies of SSI.

Preparation of Project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities: Market, Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

SLE: *Case studies on setting up of small-scale industries and institutional support.* **8 Hours**

TEXT BOOKS

1. Management and Entrepreneurship, K R Phaneesh Sudha Publications-2016.

REFERENCE BOOKS

1. Management Fundamentals Concepts, Application, Skill Development, Robert Lusier, Thompson, 2007.
2. Principles of Management, P.C. Tripathi, P.N. Reddy, Tata McGraw Hill, 2007.
3. Entrepreneurship Development, S S Khanka, S Chand & Co, 2007.
4. Management, Stephen Robbins, 17th Edition, Pearson Education / PHI, 2003.
5. Web Sites for the Institutions listed in the Unit 5 on Institutional Support.
6. Entrepreneurship development text and cases, B Janakiram, M Rizwana.

MICROPROCESSOR AND INTERFACING LABORATORY (0:0:3)

Sub code: CS5L01 **Hrs / week : 03**

Course Outcomes

On successful completion of the course the students will be able to

1. Implement assembly language programs for 8086 microprocessor for the given applications.
2. Implement assembly language interfacing applications for Elevator, Stepper Motor, Keypad, logic controller and Display interface.

Reference book:

1. **The Intel Microprocessors**, Barry.B.Brey, PHI Publication, 8th edition, 2009

DATABASE LABORATORY (0:0:3)

Sub code: CS5L02 **Hrs/week: 03**

Course Outcomes:

At the end of this course the student will be able to

1. Design a database for applications using Entity-Relationship Model.
2. Write Structured Query Language (SQL) queries to interact with the database.
3. Design and implement database applications on their own.

Reference Books:

1. The Database Book: Principles and Practice using MySQL, Narain Gehani, Universities Press (India) Private Limited 2008.
2. Fundamentals of Database Systems, Elmasri and Navathe, Addison-Wesley, 5th Edition, 2007.

MOOC ELECTIVES

SYLLABUS

INTRODUCTION TO INTERNET OF THINGS (CS5M03) (3 credits)

Week 1: Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I.

Week 2: Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II.

Week 3: Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II.

Week 4: Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications.

Week 5: Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II.

Week 6: Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

Week 7: Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT.

Week 8: SDN for IoT (contd), Data Handling and Analytics, Cloud Computing.

Week 9: Cloud Computing (contd), Sensor-Cloud.

Week 10: Fog Computing, Smart Cities and Smart Homes.

Week 11: Connected Vehicles, Smart Grid, Industrial IoT.

Week 12: Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring.

BOOKS AND REFERENCES:

1) S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press.

2) S. Misra, C. Roy, and A. Mukherjee, 2020. *Introduction to Industrial Internet of Things and Industry 4.0.* CRC Press.

3) Research Papers.

SOCIAL NETWORKS (CS5M04) (3 credits)

Week 1: Introduction.

Week 2: Handling Real-world Network Datasets.

Week 3: Strength of Weak Ties.

Week 4: Strong and Weak Relationships (Continued) & Homophily.

Week 5: Homophily Continued and +Ve / -Ve Relationships.

Week 6: Link Analysis.

Week 7: Cascading Behaviour in Networks.

Week 8: Link Analysis (Continued).

Week 9: Power Laws and Rich-Get-Richer Phenomena.

Week 10: Power law (contd..) and Epidemics .

Week 11: Small World Phenomenon.

Week 12: Pseudocore (How to go viral on web).

BOOKS AND REFERENCES:

1. Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010 (available for free download).
2. Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

INTRODUCTION TO MACHINE LEARNING (CS5M05) (3 credits)

Week 1: Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance.

Week 2: Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares.

Week 3: Linear Classification, Logistic Regression, Linear Discriminant Analysis.

Week 4: Perceptron, Support Vector Machines.

Week 5: Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation.

Week 6: Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures.

Week 7: Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting.

Week 8: Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks.

Week 9: Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation.

Week 10: Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering.

Week 11: Gaussian Mixture Models, Expectation Maximization.

Week 12: Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)

BOOKS AND REFERENCES:

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (freely available online)
2. Pattern Recognition and Machine Learning, by Christopher Bishop (optional)

SOFTWARE TESTING (CS5M06) (3 credits)

Week 1: Techniques and algorithms for test case design: Graphs based testing- structural coverage criteria.

Week 2: Graphs based testing: Data flow coverage criteria.

Week 3: Graphs based testing: Data flow coverage criteria.

Week 4: Graphs coverage for source code, design elements and requirements.

Week 5: Techniques and algorithms for test case design: Logic based testing- Predicates, logic based coverage criteria.

Week 6: Specification based logic coverage, logic coverage on finite state machines.

Week 7: Input space partitioning: Input domain modeling, combination strategies criteria.

Week 8: Syntax based testing: Coverage criteria based on syntax, mutation testing.

Week 9: Test case design (as learnt above) applied to object-oriented applications.

Week 10: Test case design (as learnt above) applied to web applications.

Week 11: Symbolic testing.

Week 12: Concolic testing, Conclusion.

BOOKS AND REFERENCES:

1. Software Testing Techniques, Boris Beizer, second edition, Dreamtech press.
2. Paul C. Jorgensen: Software Testing, A Craftsman‟s Approach, 3rd Edition, Auerbach Publications, 2008.
3. Mauro Pezze, Michal Young: Software Testing and Analysis – Process, Principles and Techniques, Wiley India, 2009.

PARAMETERIZED ALGORITHMS (CS5MXX) (3 credits)

Week 1: Kernelization.

Week 2: Bounded Search Trees.

Week 3: Iterative Compression.

Week 4: Randomised Techniques.

Week 5: Treewidth – I.

Week 6: Treewidth – II.

Week 7: Miscellaneous Techniques: ILP and DP over subsets.

Week 8: Important Separators.

Week 9: Algebraic Techniques.

Week 10: Cut and Count.

Week 11: Matroids.

Week 12: Parameterized Intractability.

BOOKS AND REFERENCES:

1. Marek Cygan, Fedor V. Fomin, Lukasz Kowalik, Daniel Lokshtanov, Dániel Marx, Marcin Pilipczuk, Michal Pilipczuk, Saket Saurabh. Parameterized Algorithms. Springer-Verlag, 2015. (Digital version freely available online.)

OPTIONAL REFERENCES:

1. R.G. Downey, M. R. Fellows: Parameterized Complexity Springer-Verlag, 1999.

2. J. Flum and M. Grohe. Parameterized Complexity Theory. Springer-Verlag, 2006.

3. R. Niedermeier. Invitation to Fixed-Parameter Algorithms. Oxford University Press, 2006.

4. Daniel Lokshtanov, Meirav Zehavi, Saket Saurabh, Fedor V. Fomin. Kernelization: Theory of Parameterized Preprocessing. Cambridge University Press, 2019.

COMPUTER VISION (CS5MXX) (3 credits)

Week 1: Fundamentals of Image processing.

Week 2: 2-D Projective Geometry, homography and Properties of homography.

Week 3: Camera geometry.

Week 4: Stereo geometry.

Week 5: Stereo geometry.

Week 6: Feature detection and description.

Week 7: Feature matching and model fitting.

Week 8: Color processing.

Week 9: Range image processing.

Week 10: Clustering and classification.

Week 11: Dimensionality reduction and sparse representation.

Week 12: Deep neural architecture and applications.

BOOKS AND REFERENCES:

1. Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
2. Computer Vision: Algorithms & Applications, R. Szeleski, Springer.
3. Computer vision: A modern approach: Forsyth and Ponce, Pearson.

NATURAL LANGUAGE PROCESSING (CS5MXX) (3 credits)

Week 1: Introduction and Basic Text Processing.

Week 2: Spelling Correction, Language Modeling.

Week 3: Advanced smoothing for language modeling, POS tagging.

Week 4: Models for Sequential tagging – MaxEnt, CRF.

Week 5: Syntax – Constituency Parsing.

Week 6: Dependency Parsing.

Week 7: Distributional Semantics.

Week 8: Lexical Semantics.

Week 9: Topic Models.

Week 10: Entity Linking, Information Extraction.

Week 11: Text Summarization, Text Classification.

Week 12: Sentiment Analysis and Opinion Mining.

BOOKS AND REFERENCES:

1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009.

   Some draft chapters of the third edition are available online: https://web.stanford.edu/~jurafsky/slp3/

2. Chris Manning and Hinrich Schütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.

*** * * * * * * ***

THE NATIONAL INSTITUTE OF ENGINEERING
MYSORE – 8

(Autonomous Institution under VTU)

Bachelor of Engineering

Scheme & Detailed Syllabus of

VI Semester

B.E (Computer Science and Engineering)

Department of Computer Science and Engineering

SCHEME OF TEACHING AND EXAMINATION

VI SEMESTER

Sl. No.	Subject Code	Subject	Category	L	T	P	Cr.
1	CS6C01	Computer Networks	Core	3	0	0	3
2	CS6C02	Cryptography	Core	3	0	0	3
3	CS6C03	Compiler Design	Core	3	2	0	4
4	CS6C04	Web Technologies and Applications	Core	3	0	0	3
5	CS6C05	Engg. Economics	Core	3	0	0	3
6	CS6E1XX	Dept. Electives - 1	Elective	3	0	0	3
7	CS6L01	Web Technologies and Applications laboratory	Lab	0	0	3	1.5
8	CS6L02	Computer Networking Laboratory	Lab	0	0	3	1.5
9	CS6C06	Minor Project	Core	0	0	4	02
	Total Credits						**24**
	Total Contact Hours						**30**

DEPT. ELECTIVES (3 Credits)

Sl. No.	Subject Code	Subject	L:T:P
1	CS6E101	Design Of The Unix Operating System	3:0:0
2	CS6E102	Computer Graphics And Visualization	3:0:0
3	CS6E103	Multimedia Computing	3:0:0
4	CS6E104	Introduction To C# Programming And .Net Concepts	3:0:0
5	CS6E105	Python Programming	3:0:0
6	CS6E106	Artificial Intelligence	3:0:0

VI SEMESTER

COMPUTER NETWORKS (3:0:0)

Sub code	**: CS6C01**	**CIE**	**: 50 %**
Hours / week	**: 03**	**SEE**	**: 50 %**
SEE Hours	**: 03 Hours**	**Max. Marks**	**: 100**

Prerequisite: Data Communications and Networking

Course Outcomes:

On successful completion of the course the students will be able to

1. Discuss the network layer services and the concepts of IP.
2. Describe the auxiliary protocol in IPV4 and working of different Unicast Routing algorithms and protocols.
3. Discuss IPV6, its features and various Multicast routing protocols.
4. Identify the functions of the Transport layer and analyze the performances of UDP and TCP protocols.
5. Explain the congestion control in TCP and working of various application layer protocols.

MODULE 1:

Network Layer-I: Network layer services: Packetizing, Routing and forwarding, other services, Packet switching: Datagram approach, Virtual circuit approach, Network layer performance, IPv4 addresses: Address space, Classful addressing, Classless addressing, DHCP, Network Address Resolution (NAT), Forwarding IP packets: based on Destination Address and longest matching, Network Layer Protocols: Internet Protocol (IP): Datagram format, fragmentation, options.

***SLE**: Security of IPv4 datagrams.* **9 Hours**

MODULE 2:

Network Layer Protocols-II ICMPv4: Messages, debugging tools, ICMP Checksum, Mobile IP: Addressing, Agents, Three phases; Unicast Routing: Introduction, General Idea, Least cost routing, Routing Algorithms: Distance Vector Routing, Link State routing, Unicast Routing Protocols:Internet Structure, Routing Information Protocol(RIP). Border Gateway Protocol(BGP): operation of External BGP(eBGP),Operation of Internal BGP(eBGP) .

***SLE:** Inefficiency in Mobile IP, OSPF* **7 Hours**

MODULE 3:

Network Layer Protocols-III: Multicast Routing: Introduction, Unicasting, Multicasting, broadcasting, Intra-domain Multicast Protocols: DVMRP, PIM (DM), IGMP: Messages, Propagation of Membership Information and Encapsulation IPv6 Addressing: Representation, Address space, Address space allocation, Auto configuration, The IPv6 Protocol: Packet Format, Extension Header, The ICMPv6 Protocol: Error Reporting Messages, Information Messages, Neighbor Discovery Messages and Group Membership Messages.

SLE: *PIM(SM),Transition from IPV4 to IPV6* **7 Hours**

MODULE 4:

Transport Layer-I: Introduction, Transport layer services: Process-to-process communication, Addressing: port numbers, ICANN ranges, Encapsulation and Decapsulation, Multiplexing and Demultiplexing, Flow Control; Transport layer protocols: Introduction: Services, Port Numbers, User Datagram Protocol: User Datagram, UDP Services. Transmission Control Protocol: TCP services, TCP Features, Segment, A TCP Connection, Windows in TCP, Flow Control, Error control: checksum, acknowledgment, generating acknowledgement, RTO, retransmission after 3 duplicates ACK segment, out of order segment.

SLE*: pushing and pulling ,UDP Applications* **7 Hours**

MODULE 5:

Transport Layer-II: TCP congestion control: Congestion Window, Congestion detection, Congestion policies, Fast Recovery, TCP timers.

Application Layer: Introduction: Providing Services, Application layer Paradigms. Client Server Programming: API, standard client server protocols: WWW &HTTP (added)

FTP, Electronic Mail: Architecture, User Agent, Message Transfer Agent. POP3, IMAP, Telnet: Local versus Remote Logging .Domain Name System: Name Space, Flat Name Space, DNS in the Internet, Resolution, Caching, Resource Records.

SLE*: SCTP: SCTP Services, SCTP features* **9 Hours**

TEXT BOOK:

1. **Data Communications and Networking,** BehrouzA. Forouzan, Tata McGraw-Hill, 5th Edition, 2013.

REFERENCEBOOKS:

1. **Computer Networks,** Andrew S. Tanenbaum, Pearson Education, 4th Edition, 2002.

2. **Data and Computer Communication,** William Stallings, Pearson Education, 8th Edition, 2007.

CRYPTOGRAPHY (3:0:0)

Course Code: CS6C02 **CIE: 50%**

Hours /week: 03 **SEE: 50%**

SEE Hours : 3 Hours **Max. Marks:100**

Prerequisites:

Concepts: Modular Arithmetic, Matrices, Linear Congruence, Algebraic structures, GF (2^n) Fields.

Course Outcomes:

On successful completion of the course the students will be able to

1. Explain the foundations of Cryptography. Critical evaluation of the risks and threats to networked computers. Demonstration of the various mechanisms to protect data and their limitations.
2. Demonstrate detailed knowledge of the role of encryption to protect data using DES & AES.
3. Familiarize with cryptographic techniques for secure (confidential) communication of two parties over an insecure (public) channel using public key algorithms.
4. Verify the integrity of the messages transmitted via an insecure channel and unique identification of the originator of any message using MAC and discuss Digital signature strategy.
5. Explain the Entity Authentication and different key management strategies

MODULE 1:

Introduction to Symmetric-Key Encipherment: Security Goals, Cryptographic Attacks, Services and mechanism, Techniques.

Traditional Symmetric-Key Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers.

SLE: *Stream and Block Ciphers* **8 Hours**

MODULE 2:

Introduction to Modern Symmetric-Key Ciphers: Modern Block Ciphers, Modern Stream Ciphers.

Data Encryption Standard (DES): Introduction, DES Structure (overview only), Security of DES.

Advanced Encryption Standard (AES): Introduction, Transformations, Key expansion, The AES Ciphers.

SLE: *Analysis of AES.* **8 Hours**

MODULE 3:

Asymmetric-Key Cryptography: RSA Cryptosystems, El-Gamal Cryptosystem, Elliptic curve crypto systems (overview only).

SLE: *Rabin cryptosystem* **7 Hours**

MODULE 4:

Message Integrity and Message Authentication: Message Integrity, Random Oracle Model, Message Authentication.

Digital Signature: Comparison, Process, Services, Attacks of Digital Signature, Digital Signature Schemes.

SLE: *HMAC* **8 Hours**

MODULE 5:

Entity Authentication: Introduction, Passwords, Challenge-Response, Biometrics.

Key Management: Symmetric-Key Distribution, Kerberos, Symmetric-key Agreement.

SLE: *Public-Key Distribution.* **8 Hours**

TEXT BOOK:

1. **Cryptography and Network Security**, Behrouz Forouzan, SIE, 2nd Edition, McGraw-Hill.

REFERENCE BOOKS:

1. **Cryptography and Network Security**, Principles and Practice; Fifth Edition. By William Stallings, Prentice Hall.
2. **Handbook of Applied Cryptography,** A. Menezes, P. and S. Vanstone, CRC Press.

COMPILER DESIGN (3:2:0)

Sub code	**: CS6C03**	**CIE**	**: 50 %**
Hours / week	**: 05**	**SEE**	**: 50 %**
SEE Hours	**: 03 Hours**	**Max. Marks**	**: 100**

Course Outcomes:

On successful completion of the course the students will be able to

1. Explain Translation, Scanning and Parsing Process of a Compiler.
2. Illustrate Top down and Bottom up Parsing.
3. Explain Semantic Analysis Phase of the compiler.
4. Compare memory organization of different run-time environments.
5. Explain code generation techniques.

MODULE 1:

INTRODUCTION AND SCANNERS: The Translation Process, The Scanning Process, The TINY Language, Design of TINY Scanner

PARSING: Abstract Syntax Trees, Syntax of the TINY language ; Syntax tree for TINY.

SLE*: Implementation of a TINY Scanne*r. **7 Hours**

MODULE 2:

TOP-DOWN PARSING: Recursive-Descent Parsing, Recursive-Descent Parser for the TINY Language. First and Follow Sets, LL(1) parsing.

BOTTOM- UP PARSING: LR(0) parsing , SLR(1) parsing

SLE: *Implementation of Recursive-Descent Parser for the TINY Language.* **8 Hours**

MODULE 3:

SEMANTIC ANALYSIS: Attributes and Attribute Grammars, The Symbol Table, Data Types and Type Checking

SLE: *A Semantic Analyzer for the TINY Language* **8 Hours**

MODULE 4:

RUNTIME ENVIRONMENTS: Memory Organization during Program Execution, Fully Static Runtime Environment, Stack-Based Runtime Environments without local procedures.

SLE: *Runtime Environment for the TINY Language* **8 Hours**

MODULE 5:

CODE GENERATION: Intermediate Code and Data Structures for Code Generation: Three-Address code and P-code, Code Generation of Data Structure References, Code Generation of Control Statements,

SLE: Code Generation of Logical Expressions **8 Hours**

Note: Refer to appendix B, "Tiny compiler listing" of the text book for implementation details

TEXT BOOK:

1. **Compiler construction, Principles and Practice** by Kenneth C Louden, Thomson Publications.

REFERENCE BOOKS:

1. **Compilers; Principles, Techniques and Tools** by Aho, **Monica** S Lam , J D Ullman, Pearson Publications.
2. **Compiler Construction by Niklaus Wirth.** An Ebook in PDF, available for free Download

WEB TECHNOLOGIES AND APPLICATIONS (3:0:0)

Sub code	**: CS6C04**	**CIE**	**: 50% Marks**
Hours /week	**: 03**	**SEE**	**: 50% Marks**
SEE Hours	**: 03 Hours**	**Max. Marks**	**: 100**

Prerequisite: Object Oriented Programming Concepts

Course outcomes:

On successful completion of the course the students will be able to

1. Interpret the basics of Java language.
2. Implement advance features of Java – inheritance, multiple inheritance, packages, interface, multithreading and exception handling.
3. Illustrate the usage of I/O streams, string handling, and networking in Java.
4. Prepare dynamic web pages using XHTML, CSS and XML.
5. Demonstrate the creation of dynamic web pages using XHTML, PHP, MYSQL.

MODULE 1:

The Java Language – 1: The Genesis of Java: Java's Lineage, The creation of Java, Why Java is important to the Internet? Java's Magic, Java features; An overview of Java Programming: Object oriented programming, simple java program, Lexical issues; Data types, Variables and Arrays: Simple types, Literals, Variables, Arrays, Operators, Control Statements, Introduction to Java Classes: Classes, Object, Methods, Constructors, The this keyword, Garbage collection, The Finalize ( ) Method.

SLE: *Type conversions and Casting* **8 Hours**

MODULE 2:

The Java Language – 2: Methods and Classes; Inheritance; Inheritance Basic, Using Super, Creating Multilevel hierarchy, When Constructors are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using Final, the Object Class; Java Packages and Interfaces; Exception Handling; Multithreading Programming.

SLE: *Creation of User defined package* **8 Hours**

MODULE 3:

Java I/O Streams & String Handling: I/O Basics, Reading Consol Input, Writing Consol Output, Reading and Writing files; String Handling: String Constructors, String Length, String Operations, Character Extraction, String Comparison, Searching String, Modifying a String, valueOf(). Networking: Networking Basics.

SLE: *StringBuffer Class.* **8 Hours**

MODULE 4

XHTML and CSS: XHTML: Basic syntax; Standard XHTML document structure; Basic text markup, Images; Hypertext Links; Lists; Tables; Forms; Frames; CSS: Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The and tags; Conflict resolution.

SLE*: Creation of Web Pages* **6 Hours**

MODULE 5

Apache Web Server , PHP and MYSQL: Introduction to Apache Web Server- Introduction, Starting, stopping and Restarting Apache, Apache Log Files, MYSQL: Introduction, Tutorial, DBI, Table Joins. PHP Introduction, Embedding PHP into HTML, Configuration, Quick examples, Language Syntax, Built-IN PHP Functions, PHP and MySQL: Connecting PHP to Mysql

SLE: *Loading and Dumping a Database, Apache Configuration* **9 Hours**

TEXT BOOKS:

1. **The Complete Reference Java 2,** Herbert Schildt, 5th Edition, Tata-McGraw-Hill, 2008
2. **Programming the World Wide Web**, Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
3. **Open Source Web Development with Lamp**, James Lee and Brent Ware, Pearson Education, 2009

REFERENCE BOOKS:

1. **Internet and World Wide Web: How to Program** -Harvey M. Deitel, Paul J. Deitel, 4thedition, Pearson, 2009.
2. **The Web Programming Building Internet Applications**- Chris Bates, 3rd Edition, Wiley India, 2006.
3. **The Java Handbook-** 1st edition, Patrick Naughton, Tata McGraw - Hill Education (1996)

ENGINEERING ECONOMICS (3:0: 0)

Sub Code	**: CS6C05**	**CIE**	**: 50 %**
Hours / Week	**: 03**	**SEE**	**: 50 %**
SEE Hours	**: 3 Hours**	**Max. Marks:**	**100**

Course outcomes:

At the end of the course, the student will be able to:

1. Explain the basic concepts of decision making, problem solving, tactics and strategy.
2. Understand Micro and Macro Economic terms.
3. Defining the time value of money concept, interest formulae.
4. Explain the concepts of depreciation and replacement criteria.
5. Calculate the total cost of a component and explain the process for estimating simple components.

MODULE 1:

Decision Making – Introduction: engineering decision – makers, engineering and economics, problem solving, intuition and analysis, tactics and strategy.

SLE: *Computational Economics* **7 Hours**

MODULE 2:

Micro Economics: Law of Demand, Law of supply, Market equilibrium and Determination of Price.

Macro Economics: Consumption goods, Capital goods, Final goods, Intermediate goods; stocks and flows; gross investment and depreciation. Circular flow of income (two sector model); Methods of calculating National Income - Value Added or Product method, Expenditure method, Income method. Aggregates related to National Income: Gross National Product (GNP), Net National Product (NNP), Gross and Net Domestic Product (GDP and NDP)

SLE: *Real and Nominal GDP* **7 Hours**

MODULE 3:

Interest and Interest Factors: Interest rate, simple interest compound interest, interest formulae, time value equivalence exercises, problems and discussion.

SLE: *Cash flow diagrams* **7 Hours**

MODULE 4:

Depreciation: Introduction, methods of depreciation, problems. Replacement Analysis: Reasons-Deterioration, obsolescence, inadequacy, replacement criteria problems.

SLE: *Causes of depreciation, reasons for replacement* **7 Hours**

MODULE 5:

Estimating and Costing: Components of costs such as direct material cost, direct labour cost, Fixed, over – heads, factory costs, administrative – over heads, first cost, selling price, calculation of the total cost of various components, Mensuration, estimation of simple components. Break Even Analysis

SLE: *Marginal Cost, Sunk Cost* **11 Hours**

TEXT BOOKS :

1. Engineering economy – Riggs J.L., McGraw Hill, 2002.

2. Engineering economy – Paul Degarmo, Macmillan Pub, Co., 2001.

3. Engineering Economy – Theusen. G. PHI, 2002.

REFERENCE BOOKS:

1. Engineering economics-R. Panneerselvam (2nd Edition), PHI Learning Pvt. Ltd., 2013.
2. Industrial Management, D K Bhattacharyya Vikas Publishing.
3. Financial Management- I.M. Pandey (9th Edition) "Financial Management", Vikas publication, 2011.

WEB TECHNOLOGIES AND APPLICATIONS LABORATORY (0:0:3)

Sub code: CS6L01 **Hours /week: 03**

Course Outcomes:

At the end of this course the student will be able to

1. Implement programs on Arrays, Stack, Class and Methods using java.
2. Demonstrate usage of Interface, Packages, Multithreading and Exception handling in java.
3. Explore working of I/O operations, String class in java.
4. Prepare web pages using HTML/XHTML and CSS.
5. Construct dynamic web pages using XHTML/HTML, PHP and MYSQL.

REFERENCE BOOKS:

1. The Complete Reference Java 2, Herbert Schildt, 5th Edition, Tata-McGraw-Hill, 2008.
2. Programming the World Wide Web, Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
3. Open Source Web Development with Lamp, James Lee and Brent Ware, Pearson Education, 2009.

COMPUTER NETWORKING LABORATORY (0:0:3)

Sub code: CS6L02 **Hours /week: 03**

Course Outcomes:

On Successful completion of the course the students will be able to

1. Create Socket and Analyze different client server model.
2. Apply different encryption and decryption strategies to achieve security goals
3. Demonstrate error detection, correction and congestion control.
4. Simulate operations of Networking protocols and devices.

REFERENCE BOOKS:

1. Introduction to Networks v6 Companion Guide, By Cisco Networking Academy Published Nov 22, 2016, Cisco Press.
2. Data Communications and Networking, BehrouzA. Forouzan, Tata McGraw-Hill, 5th Edition, 2013.
3. Todd Lammle′s CCNA/CCENT IOS Commands Survival Guide, 2nd Edition, Sybex

MINOR PROJECT (0:0:4)

Sub Code	**: CS6C06**	**CIE**	**: 100%**
Hours /week	**: 04**	**SEE Hours**	**: 2 Hours Max**
Marks	**: 50**		

Course outcome:

On successful completion of the course the students will be able to

1. Conceptualize, design and implement solutions for specific problems.
2. Apply resource management skills for projects and Communicate the solutions through presentations and technical reports.

DEPT. ELECTIVES I (CS6E1XX)

DESIGN OF THE UNIX OPERATING SYSTEM (3:0:0)

Sub code	**: CS6E101**	**CIE**	**: 50 %Marks**
Hours / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hours	**:03 Hours**	**Max. Marks**	**: 100**

Course outcome:

On successful completion of the course the students will be able to

1. Explain the Unix system concept and Kernel data structure.
2. Discuss the design of the Unix Kernel and buffer cache.
3. Illustrate the structure of the file system and Process.
4. Describe the concept of Process control and Memory management.

MODULE 1:

Overview of the UNIX System

System structure, user perspective, Operating System services, assumption about H/W. Architecture of UNIX operating system, introduction to system concepts, kernel data structure

SLE: *System Administration* **7 Hours**

MODULE 2:

The Buffer Cache

Buffer headers, structure of the buffer pool, scenarios for retrieval of a buffer, reading and writing disk blocks

SLE: *Advantages and Disadvantages of Cache* **7 Hours**

MODULE 3:

Internal Representation of Files

Inodes, structure of the regular file, directories, conversion of a pathname to inode, super block, inode assignment to a new file, allocation of disk blocks, other file types

System Calls for the File System

Change directory and change Root, Pipes, Mounting and Unmounting File Systems

SLE: *Super Block* **8 Hours**

MODULE 4:

The Structure of process

Process stages and transitions, layout of system memory, the context of a process, saving Context of a process, manipulation of the process address space

SLE: *Sleep.* **8 Hours**

MODULE 5:

Process Control

Process creation, signals, process termination, awaiting process termination, invoking other programs, the user id of a process, the shell, system Boot and the Init process.

Memory Management and I/O Subsystem

Swapping, Demand paging

SLE: *Disk Drivers* **9 Hours**

TEXT BOOK:

1. **The Design of the UNIX Operating System:** Maurice J. Bach, Prentice-Hall.

REFERENCE BOOKS:

1. **UNIX Internals:** Steve D. Pate, Addison-Wesley.
2. **UNIX Operating System Source Code Level Six:** J. Lions, Department of Computer Science, The University of New South Wales.
3. **A commentary on the sixth edition UNIX Operating System:** J. Lions, Department of Computer Science, The University of New South Wales.
4. **Operating Systems – A Practical Approach:** Robert Switzer, Prentice-Hall (1993).
5. **A Practical Approach to Operating Systems:** Malcolm G. Lane, James D. Mooney, Boyd and Fraser Pub. co. (1998).
6. **Operating System Design: The XINU Approach:** Douglas Comer, Prentice Hall, 1st edition (1983)

COMPUTER GRAPHICS AND VISUALIZATION (3:0:0)

Sub code	**: CS6E102**	**CIE**	**: 50 %Marks**
Hours / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hours	**: 03 Hours**	**Max. Marks**	**: 100**

Pre-requisite: Computer concepts and programming

Course outcome:

On successful completion of the course the students will be able to

1. Explain the basic components in computer graphic system.
2. Illustrate the OpenGL APIs and components of interactive programming.
3. Explain and Illustrate basics of geometric objects and transformations
4. Explain and demonstrate geometric transformations in homogeneous coordinates using OpenGL.
5. Analyze and compare parallel and perspective projections with relevant examples.

MODULE 1:

Introduction: Applications of computer graphics; A graphics system; Images: Physical and synthetic; Imaging Systems; The synthetic camera model; The programmer's interface; Graphics architectures; Programmable Pipelines; Performance characteristics,

***SLE**: Programmable Pipelines; Performance characteristics* **7 Hours**

MODULE 2:

Graphics Programming: The Sierpinski Gasket; Programming Two Dimensional Applications; The OpenGL API; Primitives and attributes; Color; Viewing; Control functions; The Gasket program; Polygons and recursion; Adding interactions, Menus.

***SLE:** The three-dimensional gasket;* **8 Hours**

MODULE 3:

Geometric Objects and Transformations-I: Scalars, Points, and Vectors; Three-dimensional Primitives; Coordinate Systems and Frames; Frames in OpenGL; Matrix and vector classes; Affine Transformations; Rotation.

***SLE**: Translation and Scaling;* **8 Hours**

MODULE 4:

Geometric Objects and Transformations-II: Transformation in Homogeneous Coordinates; Concatenation of Transformations; Transformation Matrices in OpenGL.

***SLE:** Interfaces to three-dimensional applications;* **8 Hours**

MODULE 5:

Viewing: Classical and computer viewing; Viewing with a Computer; Parallel Projections; Perspective Projections; Perspective Projections with OpenGL; Perspective Projection Matrices; Hidden-surface removal; Displaying Meshes.

***SLE**: Projections and Shadows.* **8 Hours**

TEXT BOOKS:

1. Edward Angel: **Interactive Computer Graphics A Top-Down Approach with OpenGL**, 6th Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Donald Hearn and Pauline Baker: Computer Graphics- OpenGL Version, 3rd Edition, Pearson Education, 2004.
2. F.S. Hill Jr.: Computer Graphics Using OpenGL, 2nd Edition, Pearson education, 2001.
3. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, Computer Graphics, Addison-Wesley 1997.

MULTIMEDIA COMPUTING (3:0:0)

Sub code	**: CS6E103**	**CIE**	**: 50 %Marks**
Hours / week	**: 03**	**SEE**	**: 50 %Marks**
SEE Hours	**: 03 Hours**	**Max. Marks**	**: 100**

Course outcome:

On successful completion of the course the students will be able to

1. Discuss types of multimedia networks and multimedia applications.
2. Compare the different types of document formats.
3. Design the different types of text compression techniques.
4. Apply different types of compression techniques on audio and images, video compression techniques.
5. Compare the different standards for the multimedia communications.

MODULE 1:

Multimedia communications

Introduction; Multimedia information representation; Multimedia networks: Telephone networks, Data networks, Broadcast television networks, Integrated services digital networks, Broadband multiservice networks; Multimedia applications : Interpersonal communications, Interactive applications over the Internet, Entertainment applications; Application and networking terminology : Media types, Communication modes, Network types, Multipoint conferencing,.

SLE: *Applications of Multimedia Communications. Network QoS, Application QoS* **8 Hours**

MODULE 2:

Multimedia information representation

Introduction; Digitization principles: Analog signals, Encoder design, Decoder design; Text: Unformatted text, Formatted text, Hypertext; Images: Graphics, Digitized documents, Digitized pictures; Audio: PCM speech, CD-quality audio, synthesized audio; Video: Broadcast television, Digital video, PC video, Video content.

SLE: *Audio and Video Representation in Multimedia* **7 Hours**

MODULE 3:

Compression Techniques(Text, Image, Audio and Video):

Introduction; Compression principles: Source encoders and destination decoders, Lossless and lossy compression, Entropy encoding, Source encoding;

Text compression: static Huffman coding, Dynamic Huffman coding, Arithmetic coding

SLE: *Lempel-Ziv coding, Lempel-Ziv-Welsh coding* **8 Hours**

MODULE 4:

Image compression: Graphics interchange format, Tagged image file format, Digitized documents, Digitized pictures, JPEG.

Audio compression: Introduction; Differential pulse code modulation, Adaptive differential PCM, Adaptive predictive coding, Linear predictive coding, Code-excited LPC, perceptual coding, MPEG audio coders.

Video compression: Video compression principles, H.261, H.263, MPEG, MPEG-1, MPEG-2,MPEG-4

SLE: *Audio Compression, Dolby audio coders, MPEG-4, H.261, H.263* **8 Hours**

MODULE 5:

Standards for multimedia communications: Introduction; Reference models: TCP/IP reference model, protocol basics; Standards relating to interpersonal communications: Circuit-mode networks, packet-switched networks, Electronic mail; Standards relating to interactive applications over the Internet: Information browsing, Electronic commerce, Intermediate systems, java and JavaScript; Standards for entertainment applications: Movie/video-on-demand, Interactive television.

SLE: *Standards for Multimedia Communications, Video on Demand* **8 Hours**

TEXT BOOK:

1. **Multimedia Communications – Applications, Networks, Protocols and Standards** – FredHalsall, Pearson Education, 2009.

REFERENCE BOOKS:

1. Multimedia computing, communications and Applications - Ralf Steinmetz, KlaraNarstedt, 2nd Edition, Pearson Education, 2001.
2. Multimedia System Design- Prabhat K. Andleigh, KiranThakrar, PHI, 2003.
3. Multimedia Communication Systems: Techniques, Standards and Networks–K.R. Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, Pearson Education 2002.
4. Multimedia Information Networking- Nalin K. Sharad, PHI, 2002.

INTRODUCTION TO C# PROGRAMMING AND .NET CONCEPTS (3:0:0)

Sub code : CS6E104	**CIE : 50%Marks**
Hours /week : 03	**SEE : 50%Marks**
SEE Hours : 03 Hours	**Max. Marks : 100**

Course Outcome:

On successful completion of the course the students will be able to

1. Explain the basics of .Net platform and the role of base class libraries, role of common intermediate language and namespaces.
2. Discuss the fundamentals of c# and to build the basic c# program using different constructs.
3. Review the basic pillars of object oriented programming concepts.
4. Apply the exception handling technique to handle different types of errors, Provide the knowledge about basics of object lifetime.
5. Define the use of interfaces and collections, Explain the call-back interfaces, delegates, events and its implementation.

MODULE 1:

THE PHILOSOPHY OF .NET: Understanding the Previous State of Affairs, The .NETSolution, The Building Block of the .NET Platform (CLR,CTS, and CLS), The Role of the .NET Base Class Libraries, What C# Brings to the Table, An Overview of .NET Binaries (aka Assemblies), the Role of the Common Intermediate Language , The Role of .NET Type Metadata, The Role of the Assembly Manifast, Compiling CIL to Platform –Specific Instructions, Understanding the Common Type System, Intrinsic CTS Data Types, Understanding the Common Languages Specification, Understanding the Common Language Run-time A tour of the .NET Namespaces.

SLE: *Increasing Your Namespace Nomenclature* **8 Hours**

MODULE 2:

C# LANGUAGE FUNDAMENTALS: The Anatomy of a Basic C# Class, Creating objects:Constructor Basics, The Composition of a C# Application, Default Assignment and Variable Scope, The C# Member Initialization Syntax, Basic Input and Output with the Console Class, Understanding Value Types and Reference Types, The Master Node System.Object, The System Data Types (and C# Aliases), Converting Between Value Types and Reference Types Boxing and Unboxing, Defining Program Constants, C# Iteration Constructs, C# Controls Flow Constructs, The Complete Set of C# Operators, Defining Custom Class Methods, Understating Static Methods, Methods Parameter Modifies, Array Manipulation in C #, String Manipulation in C#, C# Enumerations, Defining Structures in C#, Defining Custom Namespaces.

SLE: *Programming using basic constructs of c#* **8 Hours**

MODULE 3:

OBJECT- ORIENTED PROGRAMMING WITH C#: Forms Defining of the C# Class, Definition the "Default Public Interface" of a Type, Recapping the Pillars of OOP, The First Pillars: C#'s Encapsulation Services, Pseudo- Encapsulation: Creating Read-Only Fields, The Second Pillar: C#'s Inheritance Supports, keeping Family Secrets: The "Protected" Keyword, Nested Type Definitions, The Third Pillar: C #'s Polymorphic Support, Casting Between.

SLE: *Object oriented programming using VS.NET* **7 Hours**

MODULE 4:

EXCEPTIONS: Ode to Errors, Bugs, and Exceptions, The Role of .NET Exception Handing,the System. Exception Base Class, Throwing a Generic Exception, Catching Exception, CLR System – Level Exception (System.System Exception), Custom Application-Level Exception (System. System Exception), Handling Multiple Exception, The Family Block, the Last Chance Exception Dynamically Identifying Application – and System Level Exception Debugging System.

OBJECT LIFETIME: Understanding Object Lifetime, the CIT of "new', The Basics ofGarbage Collection,, Finalization a Type, The Finalization Process, Building an Ad Hoc Destruction Method, Garbage Collection Optimizations.

SLE: *Exception Using VS.NET, The System. GC Type.* **8 Hours**

MODULE 5:

INTERFACES AND COLLECTIONS: Defining Interfaces Using C# Invoking Interface Members at the object Level, Exercising the Shapes Hierarchy, Understanding Explicit Interface Implementation, Interfaces As Polymorphic Agents, Building Interface Hierarchies, **CALLBACK INTERFACES, DELEGATES, AND EVENTS, ADVANCED TECHNIQUES:** Understanding Callback Interfaces, Understanding the .NET Delegate Type, Members of System. Multicast Delegate, The Simplest Possible Delegate Example, Building More a Elaborate Delegate Example, Understanding Asynchronous Delegates, Understanding (and Using) Events.

SLE :*Building custom Interfaces and collections using VS.NET, Building callback interfaces, delegates and events using VS.NET* **8 Hours**

TEXT BOOK:

1. **C# and the .NET platform** - Andrew Troelsen, Special Edition, Dream Tech Press, India, 2003.

REFERENCE BOOK:

1. Inside C# - Tom Archer, WP Publishers, 2001.

PYTHON PROGRAMMING (3:0:0)

Sub Code	**: CS6E105**	**CIE : 50% Marks**
Hours/Week	**: 03**	**SEE : 50% Marks**
SEE Hours	**: 03 Hours**	**Max. Marks : 100**

Pre-requisite: Computer Programming Concepts

Course Outcomes:

On Successful Completion of the Course, the students will be able to:

1. Explain core ideology of Python and write simple python programs using numeric types.
2. Use String, List and Dictionary types in Python for data storage and processing.
3. Use various python control statements to develop applications.
4. Demonstrate use of advanced function features in Python.
5. Apply OOP features in python and exception handling.

MODULE 1:

Introduction**:** Why do people use Python? Who uses Python today? What can I do with Python? What are Python's technical strengths? Introducing Python Object Types, The Python Conceptual Hierarchy, Why Use Built-in Types? Python's Core Data Types.

Numeric Types: Numeric Type Basics, Numbers in Action, Dynamic Typing Interlude, Case of the Missing Declaration Statements.

SLE: *Shared References.* **7 Hours**

MODULE 2:

String Fundamentals: String Basics, String Literals, String in Action, String Methods.

Lists and Dictionaries: Lists, Lists in action, Dictionaries, Dictionaries in action.

'Tuples-Files and Everything Else': Tuples, Files.

SLE : *Sets* **8 Hours**

MODULE 3:

Statements and Syntax: Assignments, Expressions, and Prints: Assignment Statements-Assignment Statement Forms, Sequence Assignments. if Tests and Syntax Rules: if statements, while and for Loops: while loops,break, continue, pass, and the Loop else. For Loops.

SLE: *Loop Coding Techniques* **6 Hours**

MODULE 4:

Function Basics: Why Use Functions, Coding Functions, Examples: Definitions and Calls, Intersecting Sequences. Arguments: Argument-Passing Basics, Special Argument-Matching Modes: Argument Matching Basics, Argument Matching Syntax. Headers: Collecting arguments, Calls: Unpacking arguments.

Advanced Function Topics: Anonymous Functions-lambda, Functional Programming Tools-map, filter, reduce.

SLE: *Keyword and Default Examples.* **9 Hours**

MODULE 5: Classes and OOP: Class Coding Basics: Classes Generate Multiple Instance Objects, Classes Are Customized by Inheritance, Classes Can Intercept Python Operators, The World's Simplest Python Class, Class Coding Details: The class Statement, Methods, Inheritance

Exception Basics: Why Use Exceptions? Exceptions: The Short Story, Exception Coding Details: The try/except/else Statement, The raise Statement

SLE: *Namespaces: The Conclusion.* **9 Hours**

TEXT BOOK:

1. **Learning Python,** Mark Lutz, O'Reilly Media, 5th Edition , 2013.

REFERENCE BOOKS:

1. **Introducing Python –** Modern Computing in Simple Packages, Bill Lubanovic, O'Reilly Media, First Edition.
2. **Think Python -** How to Think Like a Computer Scientist**,** Allen Downey, Green Tea Press, 2nd Edition (2.0.17)

WEB LINKS:

1. **Official Python Documentation:** https://docs.python.org
2. **Full Stack Python:**https://www.fullstackpython.com/

ARTIFICIAL INTELLIGENCE (3:0:0)

Sub Code	**: CS6E106**	**CIE**	**: 50%**
Hours /Week	**: 03**	**SEE**	**: 50%**
SEE Hours	**: 3 Hours**	**Max Marks**	**: 100**

Course Outcomes:

On Successful completion of the course, the students will be able to

1. Define Artificial Intelligence point-out the role of computer engineers in Artificial Intelligence.
2. Categorize the properties of task environment.
3. Devise various strategies in formulation problems.
4. Compare various search techniques used in AI.
5. Computer optimal decisions in games.

MODULE 1:

Introduction, Definition of AI, The foundations of Artificial Intelligence, Applications of AI.

Self Learning Exercise: *State of the art in AI.* **6 Hours**

MODULE 2:

Intelligent agent, Agents and environments, behavior. The concept of rationality. The nature of environments. The structure of agents.

Self Learning Exercise: *How the components of agent's program work?* **8 Hours**

MODULE 3:

Solving problems by searching problem solving agents, example problems, searching for solutions, uninformed search strategies, Informed (heuristic) search strategies, Heuristic functions.

Self Learning Exercise: *Learning heuristics from experience.* **8 Hours**

MODULE 4:

Beyond classical search Local search algorithms and optimization problems – this climbing search, simulated annealing, local beam search, genetic algorithms, local search in continuous spaces, searching with nondeterministic action searching with partial observations. Online search agents and unknown environments

Self Learning Exercise: *Learning in online search.* **8 Hours**

MODULE 5:

Adversarial search Games, optimal decision in games, Alpha-beta pruning, imperfect real-time decision, Stochastic games, Partially observable games

Self Learning Exercise: *State of the art game programming.* **9 Hours**

TEXTBOOK:

1. Artificial Intelligence A modern Approach Stuart Russell, Peter Norvig Third edition, Pearson publication, 2015.

REFERENCE BOOK:

1. Artificial Intelligence Saroj Kaushik, Cengage learning, 2011.

*** * * * * * * ***